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Recording Single Molecule Dynamics and Function using Carbon Nanotube Circuits YONGKI CHOI, PATRICK SIMS, ISSA MOODY, TIVOLI OLSEN, BRAD L. CORSO, O. TOLGA GUL, GREGORY A. WEISS, PHILIP G. COLLINS, Departments of Physics and Astronomy, Molecular Biology and Biochemistry, and Chemistry, University of California Irvine, Irvine, CA 92697 — Nanoscale electronic devices like field-effect transistors (FETs) have long promised to provide sensitive, label-free detection of biomolecules. In particular, single-walled carbon nanotubes (SWNTs) have the requisite sensitivity to detect single molecule events, and have sufficient bandwidth to directly monitor single molecule dynamics in real time. Recent measurements have demonstrated this premise by monitoring the dynamic, single-molecule processivity of three different enzymes: lysozyme, protein Kinase A, and the Klenow fragment of polymerase I. Initial successes in each case indicate the generality and attractiveness of SWNT FETs as a new tool to complement other single molecule techniques. Furthermore, our focused research on transduction mechanisms provides the design rules necessary to further generalize this SWNT FET technique. This presentation will summarize these rules, and demonstrate how the purposeful incorporation of just one amino acid is sufficient to fabricate effective, single molecule nanocircuits from a wide range of enzymes or proteins.

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